

MOUNTING
TOOL

NEW HOT GRINDING AND HOT CUTOFF SYSTEMS

51/322

*An advancement in new
concepts in billet and slab conditioning
that can double your snagging
rate, triple your
cutoff rate*



CARBORUNDUM

Received June 1965
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New Carborundum® Hot Grinding Systems double metal removal rates, speed up conditioning, cut costs & production time

Carborundum abrasive grinding wheels are now capable of taking off imperfections and impurities from billets and ingots with skin temperatures up to 2000°F. Compared to conventional cold grinding, this new Carborundum hot grinding process offers many advantages for metal-conditioning operations.

6

Major benefits of hot grinding

Doubles removal rates

Under conditions of equal load on the grinding wheel, hot grinding permits you to take off metal at about twice the rate of room-temperature methods. Ratios of metal removed to abrasive wheel loss are about the same for hot grinding and cold grinding, although there have been some cases of better ratio for hot grinding.

Requires 1/3 the power

Hot grinding with Carborundum Hot Grind Wheels requires approximately one-third the power on the grinding spindle to remove one cubic inch of metal per minute.

Increases productivity

For a given amount of wheel pressure, the hot grinding process removes more metal. In order to keep the amount of metal removed at the desired level, the rate of wheel traverse is speeded up. Result: faster production.

Better finish

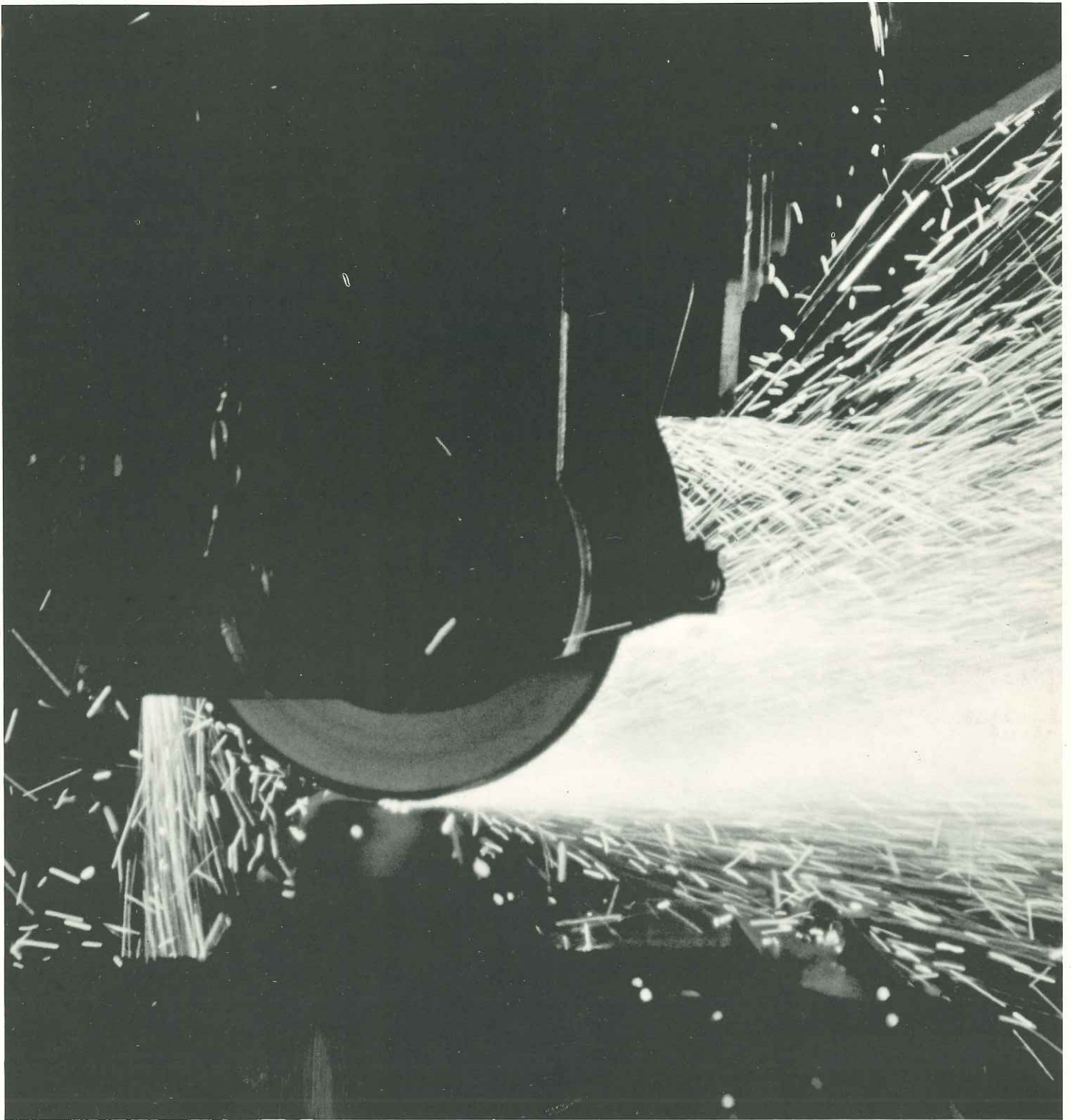
Besides raising productivity, Carborundum hot grinding can produce a higher-quality product. Tests show a smoother surface finish, with ridges not as severe as occurs with cold grinding. Hot grinding has worked well on metals ranging from tool and alloy steels to stainless steel and titanium.

In-line processing

Hot grinding is a natural supplement to continuous casting. It offers the promise of in-line processing of metal directly from the furnace to the rolling mill, and a shortcut to fully automated production.

Employs standard equipment

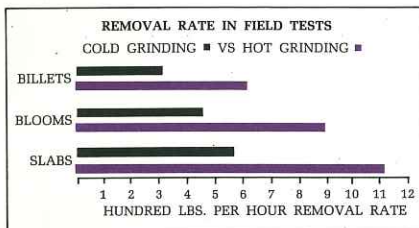
Conventional grinding wheels can be used for hot grinding. Carborundum has applied a new resinoid wheel formulation that does a better job under heat. Still, this wheel and the equipment used are all standard.



Field tests prove benefits of Carborundum hot grinding

Following laboratory work on abrasive grinding of hot metal, joint field studies have been conducted by Carborundum's Bonded Abrasive Division and Tysman Machine Company with Braeburn Steel, United States Steel and Lukens Steel.

The following chart shows the relative cutting rate on grinding billets, blooms and slabs—cold versus hot.



Regarding these tests
as a whole:

1

Steel temperature

Carborundum abrasive grinding wheels can be used on very hot steel—1100° to 2000°F—for periods of time that reflect normal continuous grinding periods.

2

Removal speed

Hot grinding removes metal so much faster than conventional grinding that a combination of lower pressures and greater traverse feed rates points the way to greater productivity **without overgrinding**.

3

Horsepower and productivity

Because horsepower requirements are lower, greater productivity can be expected with the same power, or with a given machine more metal can be removed at a higher rate with hot grinding than with cold.

Arborless Wheel

Another test was run at Atlas Steel, Welland, Ontario, where the grinding machine operated at **16,000 surface feet per minute** with a 75-horsepower motor.

This test was run with the new Carborundum Arborless Wheel. The Arborless Wheel concept guarantees that Carborundum wheels designed for hot grinding can be used at higher speeds right down to the flanges (see Bulletin A1903).

Hot grinding applications

The following application concepts are listed for your consideration. They may stimulate and direct your thinking to ideas of how you can profitably apply hot grinding techniques and systems to your advantage. Consider these areas of application:



A De-carb removal

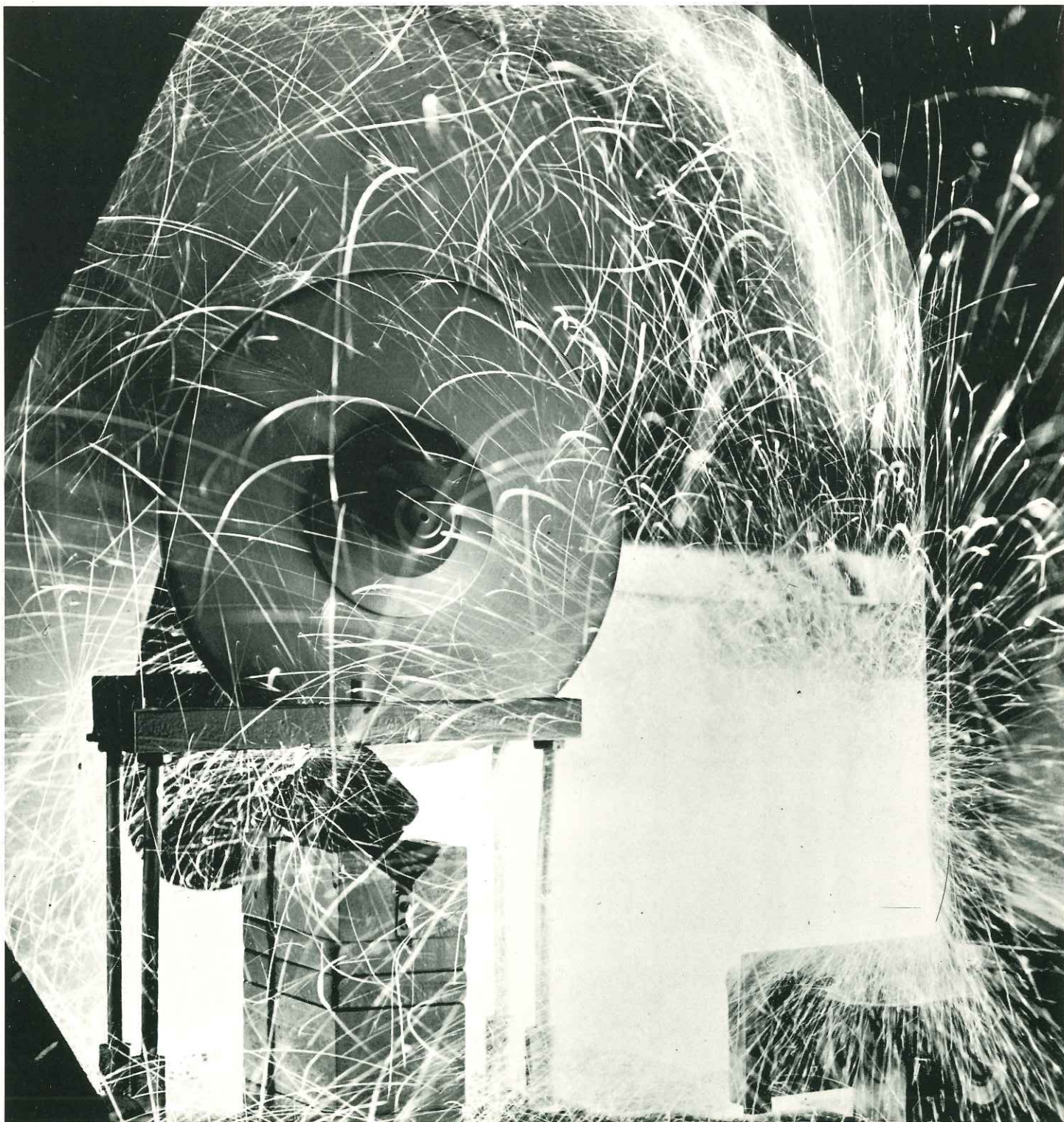
The Carborundum hot grinding process offers benefits by removing de-carb from billets immediately prior to their being rolled into the desired mill-product shapes. A few minutes before the billet is needed in the mill, it would be withdrawn and rapidly ground to remove the de-carb layer. The billet would then be reinserted into the furnace to recover whatever temperature was lost, and then it would be processed through the mill in the regular way.

B Scale removal

Scale formed in soaking pits is not adequately removed by the water-blasting methods now normally employed. The remaining scale, which is imbedded during the slabbing and hot rolling operations, causes serious problems in subsequent processing. Also, scale may cause quality problems in finished products. Carborundum hot grinding could remove this scale with light skinning passes over the hot ingot or slab. Time involved could be kept short to avoid delaying mill operations.

C Slab grinding

One of the most promising applications of Carborundum hot grinding is the conditioning of slabs, particularly of stainless and alloy steels. The hot grinding process envisaged would be applicable to slabs made from ingots or by continuous or pressure casting.



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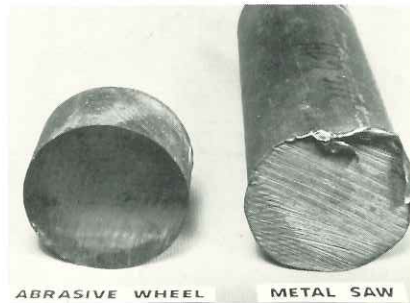
Replace other conditioning methods

The great improvements offered by the Carborundum hot grinding process call for a re-examination of other conditioning methods to determine if they are still economically sound. For example, hand scarfing is a conditioning method which could be improved upon by converting to grinding. Scarfing labor costs are high. There are safety and health problems. Scarfing results in an inferior surface finish, compared with grinding, and often removes more metal than necessary.

The total usefulness and benefits of hot grinding for you depend upon the specifics of the possible applications in your operation.

Carborundum stands ready to assist you in total exploitation of the cost and quality advantages that hot grinding offers.

New Carborundum Hot Cutoff Systems boost cutting speed and quality, lower power requirements and overall cost



Abrasive hot cutoff (left) shows clean, burr free surface when compared to cut on right made by metal saw.

Today, Carborundum abrasive cutoff wheels are cutting metals at temperatures as high as 1600°F. The resulting advantages of hot cutoff over cutting at room temperature are great. Extensive testing of the differences in performance between hot and cold cutting has produced the following results.

Hot cutoff advantages

Faster cutting. When a Carborundum cutoff wheel cut a 3" x 3" billet of AISI 1340 standard alloy steel at 1600°, the rate of metal cut increased 149% over cutting at room temperature. The billet was cut in 7 seconds, which translates into 0.7 second per square inch cut.

Lower power requirements. In every test, as the temperature of the steel increased, the power requirement dropped. At 1600° the power requirement was 37% less than at room temperature. Horsepower required for hot cutting ranged from 3 to 5 horsepower to cut one cubic inch per minute.

Higher-quality cut. In addition to the improved cutting performance, hot cutoff with a Carborundum wheel produces a practically burr-free, higher-quality cut.

Longer wheel life. Wheel life is related to the temperature of the metal that is cut, and wheel life increased 12 to 43% when the metal was cut hot. Hot cutting increased wheel life in each test without changing the productivity rate. Consequently the cost of cutoff was reduced.

Lower overall costs. The following chart provides background on the relative cost of cutting hot compared to cold:

Machine ... Chopper-type Cutoff Machine								
Wheel Specification ... A24-T-BFCW								
Wheel Size ... 24" x 3 1/16" x 1 1/2"								
Wheel Speed ... 19,000 S.F.P.M.								
Material Cut ... Hot Work Steel-2 1/8" diameter round								
Cutting Fluid ... None-dry cutting								
Procedure ... Plunge Cut								
Temperature of Steel Degrees Fahrenheit	Time Per Cut Seconds	Volume Ratio	Cutting Rate Cu. Ins./Min.	H.P./Cu. In. Per Minute	Relative Cost			
					Labor + Burden	Abra.	Total	
Room	16	1.3	5.6	8.4	100	100	100	
1600	10	1.4	9.3	3.9	59	95	73	

In this test, by changing to hot cutoff at 1600°F. the total cost was reduced 37%. Labor plus burden cost was reduced 41%; abrasive cost was reduced 5%.

The relationship of abrasive cost to total cost is more reasonable in the hot cutoff operation. In the hot cutoff process, the abrasive cost approximately equalled the labor plus burden cost. In cold cutoff, the abrasive cost was only approximately 40% of the total cost.

Comparable data compiled when cutting hot steels in the chrome, moly, tungsten class shows trends identical to those produced when cutting the standard alloy steel. Productivity rate increased as much as 115%. Power consumed decreased as much as 42%. Wheel life increased as much as 44%.

Operations where hot cutoff appears immediately beneficial are those now being done by saws, shears, and flame cutting methods. The heavy burr of the saw would be replaced by the light burr of the abrasive wheel.

Other operations where abrasive cutting can be used include:

- ▶ **cropping of billets and blooms**
- ▶ **cutting blooms and billets to size**
- ▶ **cutting off the necks of blooms prior to forging**
- ▶ **cutting hot forgings**
- ▶ **cutting out metallurgical samples while hot**
- ▶ **cutting to size in continuous casting operations.**

In a hot cutoff operation, an abrasive wheel, a machine, and a technique of cutting all are involved. All are integrated finally into the cost of cutoff. We at Carborundum are ready and willing to assist you to explore and to exploit the hot cutoff process in terms of the specifics of your applications.

Cooperative exploitation for hot slab conditioning or cutoff

How can you best determine the many cost and quality advantages that Carborundum hot grinding and hot cutoff offer in **your** operation?

We offer the general procedure outlined below as a basis for cooperative work.

1

Feasibility study phase

Engineers of your company and of Carborundum discuss the prospective hot grinding or hot cutoff application in detail. Consideration is given to your present plant layout and operations. Preliminary estimates are made of capital and operating costs for several concepts of a production installation. Where needed to aid in a judgment, tests are run, either in your facilities or at Carborundum. Personnel from both companies participate. Promising studies move into the . . .

2

Engineering phase

You provide a detailed definition of

the production that will be put through the grinding or cutoff installation: types of steel, sizes and shapes of pieces, thickness of metal to be removed, throughput rate including surges in production, etc.

Carborundum determines, from its records or by testing, such important characteristics as metal removal rate vs. temperature, abrasive costs per unit metal removal vs. temperature, and horsepower needed per unit metal removed per minute vs. temperature. Several machine concepts are evaluated jointly and the best one is selected. Accurate estimates are made of the investment and operating costs of the proposed new facility. Sufficient machine design, materials handling, and plant layout engineering are performed jointly to permit these estimates. Projects offering sufficient justification then go to the . . .

3

Installation and operation phase

You decide the means for installing the hot grinding or hot cutoff facility. Carborundum may bid on providing the entire system.

We assist you during initial operation of the facility to assure full utilization of hot grinding or hot cutoff process capabilities.

Your exploitation of new concepts.

These Hot Grinding and Hot Cutoff System concepts are new and may seem a rather radical departure from traditional practices. We believe at Carborundum that these extensions in grinding and cutoff technology and practice promise great benefits to the steel industry. We hope that you will take advantage of the opportunity to investigate these concepts with your associates and our representatives and reap the rewards that these concepts hold.

For definitive information on Hot Grinding and Hot Cutoff Systems as they apply to your operations, call the District Sales Manager at the Carborundum District Office nearest you (see below) or contact our Bonded Abrasives Division headquarters, Sales Engineering Dept., Niagara Falls, N. Y. Area Code 716, 278-2413.

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